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TITLE: METHOD AND SYSTEM FOR ENABLING A DEVICE FUNCTION OF A VEHICLE

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METHOD AND SYSTEM FOR ENABLING A DEVICE FUNCTION OF A VEHICLE

FIELD OF THE INVENTION

This invention relates generally to telematics systems. In particular the invention relates to a method and system for enabling a device function of a vehicle.

BACKGROUND OF THE INVENTION

One of the fastest growing areas of communications technology is related to automobile network solutions. The demand and potential for wireless vehicle communication, networking and diagnostic services have recently increased. Although many vehicles on the road today have limited wireless communication functions, such as unlocking a door and setting or disabling a car alarm, new vehicles offer additional wireless communication systems that help personalize comfort settings, run maintenance and diagnostic functions, place telephone calls, access call-center information, update controller systems, determine vehicle location, assist in tracking vehicle after a theft of the vehicle and provide other vehicle-related services. Drivers can call telematics call centers and receive navigational, concierge, emergency, and location services, as well as other specialized help such as locating the geographical position of a stolen vehicle and honking the horn of a vehicle when the owner cannot locate it in a large parking garage. Telematics service providers can offer enhanced telematics services by supplying a subscriber with a digital handset.

With speech recognition available in today's vehicles a driver can control devices within the vehicle without removing their hands from the steering wheel. Drivers receive various forms of information while operating a vehicle such as phone numbers or destination addresses. While a driver is on the road, it is not convenient for them to record the information and then input that information to a vehicle device such as an in-vehicle phone or navigation system. Information of interest to a driver can be a part of a conversation the driver has with another person and not in a format directly usable by a vehicle device.

The driver can receive a business address as part of a conversation with a person at the business. To use that address with the vehicles navigation system, the driver must remember or record the address, enable the navigation system and input the address to the navigation system. This requirement is both an inconvenience for the driver and a limitation that decreases the driver's satisfaction with the capabilities of the navigation system.

It is desirable therefore, to provide a method and system for enabling a device function of a vehicle, that overcomes the challenges and obstacles described above.

SUMMARY OF THE INVENTION

The current invention provides a method for enabling a device function of a vehicle. A speech input stream is received at a telematics unit. A speech input context is determined for the received speech input stream. The received speech input stream is processed based on the determination and the device function of the vehicle is enabled responsive to the processed speech input stream. The method further comprises directing a vehicle device in control of the device function based on the processed speech input stream.

Another aspect of the current invention provides a computer usable medium including computer program code for enabling a device function of a vehicle. The computer usable medium comprises: computer program code for receiving a speech input stream at a telematics unit; computer program code for determining a speech input context for the received speech input stream; computer program code for processing the received speech input stream based on the determination; and computer program code for enabling the device function of the vehicle responsive to the processed speech input stream. The computer usable medium further comprises computer program code for directing a vehicle device in control of the device function based on the processed speech input stream.

Another aspect of the current invention provides a system for enabling a device function of a vehicle. The system comprises: means for receiving a speech input stream at a telematics unit; means for determining a speech input context for the received speech input stream; means for processing the received speech input stream based on the determination; and means for enabling the device function of the vehicle responsive to the processed speech input stream. The system further comprises means for directing a vehicle device in control of the device function based on the processed speech input stream.

The aforementioned and other features and advantages of the invention will become further apparent from the following detailed description of the presently preferred embodiment, read in conjunction with the accompanying drawings. The detailed description and drawings are merely illustrative of the invention rather than limiting, the scope of the invention being defined by the appended claims and equivalents thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic diagram of a system for enabling a device function of a vehicle in accordance with one embodiment of the current invention;

FIG. 2 is a flow diagram of a method for enabling a device function of a vehicle in accordance with one embodiment of the current invention;

FIG.3 is a flow diagram detailing the step of determining the speech input context at block **220** of **FIG.2**;

FIG. 4 is a flow diagram detailing the step of processing the received speech input stream at block **230** of **FIG. 2**; and

FIG. 5 is a flow diagram detailing the step enabling the device function of the vehicle at block **240** of **FIG. 2**.

DETAILED DESCRIPTION OF THE
PRESENTLY PREFERRED EMBODIMENTS

FIG. 1 is a schematic diagram of a system for enabling a device function of a vehicle in accordance with one embodiment of the current invention at **100**. The system for enabling a device function of a vehicle at **100** comprises: a mobile vehicle **110**, a telematics unit **120**, one or more wireless carrier systems **140**, or one or more satellite carrier systems **141**, one or more communication networks **142**, and one or more call centers **180**. Mobile vehicle **110** is a vehicle such as a car or truck equipped with suitable hardware and software for transmitting and receiving speech and data communications. Vehicle **110** has a multimedia system **118** having one or more speakers **117**.

In one embodiment of the invention, telematics unit comprises: a digital signal processor (DSP) **122** connected to a wireless modem **124**; a global positioning system (GPS) receiver or GPS unit **126**; an in-vehicle memory **128**; a microphone **130**; one or more speakers **132**; an embedded or in-vehicle phone **134** or an email access appliance **136**; and a display **138**. DSP **122** is also referred to as a microcontroller, controller, host processor, ASIC, or vehicle communications processor. GPS unit **126** provides longitude and latitude coordinates of the vehicle, as well as a time stamp and a date stamp. In-vehicle phone **134** is an analog, digital, dual-mode, dual-band, multi-mode or multi-band cellular phone.

Telematics unit **120** can store a processed speech input stream, GPS location data, and other data files in in-vehicle memory **128**. Telematics unit **120** can set or reset calling-state indicators and can enable or disable various cellular-phone functions, telematics-unit functions and vehicle functions when directed by program code running on DSP **122**. Telematics unit **120** can send and receive over-the-air messages using, for example, a pseudo-standard air-interface function or other proprietary and non-proprietary communication links.

DSP **122** executes various computer programs and computer program code, within telematics unit **120**, which control programming and operational modes of electronic and mechanical systems. DSP **122** controls communications between telematics unit **120**, wireless carrier system **140** or satellite carrier system **141** and call center **180**. A speech-recognition engine **119**, which can translate human speech input through microphone **130** to digital signals used to control functions of telematics unit, is installed in telematics unit **120**. The interface to telematics unit **120** includes one or more buttons (not shown) on telematics unit **120**, on multimedia system **118**, or on an associated keyboard or keypad that are also used to control functions of telematics unit. A

text to speech synthesizer **121** can convert text strings to audible messages that are played through speaker **132** of telematics unit **120** or through speakers **117** of multimedia system **118**.

Speech recognition engine **119** and buttons are used to activate and control various functions of telematics unit **120**. For example, programming of in-vehicle phone **134** is controlled with verbal commands that are translated by speech-recognition software executed by DSP **122**. Alternatively, pushing buttons on interface of telematics unit **120** or on in-vehicle phone **134** is used to program in-vehicle phone **134**. In another embodiment, the interface to telematics unit **120** includes other forms of preference and data entry including touch-screens, wired or wireless keypad remotes, or other wirelessly connected devices such as Bluetooth-enabled devices or 802.11-enabled devices.

In one embodiment of the current invention, speech recognition engine **119** comprises a configurable listener automaton **111** that receives a speech input stream and processes the speech input stream according to a set of rules and structures defined in a domain specific actuator. The listener automaton **111** writes the processed speech input stream to an activation cache that is a portion of in-vehicle memory **128**. DSP **122** executes computer program code comprising a context recognizer and associated domain specific actuators, within telematics unit **120**, which control operation and configuration of the listener automaton **111**. DSP **122** controls communications between telematics unit **120**, listener automaton **111**, and activation cache in in-vehicle memory **128**. Data in the activation cache is supplied to the vehicle devices **115** through vehicle bus **112**.

DSP **122** controls, generates and accepts digital signals transmitted between telematics unit **120** and a vehicle communication bus **112** that is connected to various vehicle components **114**, vehicle devices **115**, various sensors **116**, and multimedia system **118** in mobile vehicle **110**. DSP **122** can activate various programming and operation modes, as well as provide for data transfers. In facilitating interactions among the various communication and electronic modules, vehicle communication bus **112** utilizes bus interfaces such as controller-area network (CAN), J1850, International Organization for Standardization (ISO) Standard 9141, ISO Standard 11898 for high-speed applications, and ISO Standard 11519 for lower speed applications.

Mobile vehicle **110** via telematics unit **120** sends and receives radio transmissions from wireless carrier system **140**, or satellite carrier system **141**. Wireless carrier system **140**, or satellite carrier system **141** is any suitable system for transmitting a signal from mobile vehicle **110** to communication network **142**.

Communication network **142** includes services from mobile telephone switching offices, wireless networks, public-switched telephone networks (PSTN), and Internet protocol (IP) networks. Communication network **142** comprises a wired network, an optical network, a fiber network, another wireless network, or any combination thereof. Communication network **142** connects to mobile vehicle **110** via wireless carrier system **140**, or satellite carrier system **141**.

Communication network **142** can send and receive short messages according to established protocols such as dedicated short range communication standard (DSRC), IS-637 standards for short message service (SMS), IS-136 air-interface standards for SMS, and GSM 03.40 and 09.02 standards. In one embodiment of the invention, similar to paging, an SMS communication is posted along with an intended recipient, such as a communication device in mobile vehicle **110**.

Call center **180** is a location where many calls are received and serviced at the same time, or where many calls are sent at the same time. In one embodiment of the invention, the call center is a telematics call center, facilitating communications to and from telematics unit **120** in mobile vehicle **110**. In another embodiment, the call center **180** is a voice call center, providing verbal communications between a communication service advisor **185**, in call center **180** and a subscriber. In another embodiment, call center **180** contains each of these functions.

Communication services advisor **185** is a real advisor or a virtual advisor. A real advisor is a human being in verbal communication with a user or subscriber. A virtual advisor is a synthesized speech interface responding to requests from user or subscriber. In one embodiment, the virtual advisor includes one or more recorded messages. In another embodiment, the virtual advisor generates speech messages using a call center based text to speech synthesizer (TTS). In another embodiment, the virtual advisor includes both recorded and TTS generated messages.

Call center **180** provides services to telematics unit **120.** Communication services advisor **185** provides one of a number of support services to a subscriber. Call center **180** can transmit and receive data via a data signal to telematics unit **120** in mobile vehicle **110** through wireless carrier system **140**, satellite carrier systems **141**, or communication network **142**.

Call center **180** can determine mobile identification numbers (MINs) and telematics unit identifiers associated with a telematics unit access request, compare MINs and telematics unit identifiers with a database of identifier records, and send calling-state messages to the telematics unit **120** based on the request and identification numbers.

Communication network **142** connects wireless carrier system **140** or satellite carrier system **141** to a user computer **150**, a wireless or wired phone **160**, a handheld device **170**, such as a personal digital assistant, and call center **180**. User computer **150** or handheld device **170** has a wireless modem to send data through wireless carrier system **140**, or satellite carrier system **141,** which connects to communication network **142**. In another embodiment, user computer **150** or handheld device **170** has a wired modem that connects to communications network **142**. Data is received at call center **180**. Call center **180** has any suitable hardware and software capable of providing web services to help transmit messages and data signals from user computer **150** or handheld device **170** to telematics unit **120** in mobile vehicle **110**.

FIG. 2 is a flow diagram of a method for enabling a device function of a vehicle in accordance with one embodiment of the current invention at **200**. The method enabling a device function of a vehicle at **200** begins (block **205**) when a speech-input stream is received at a telematics unit from a speech source (block **210**). The speech source can be human speech or speech generated by a speech synthesizer. A speech input context is determined for the received speech input stream (block **220**). The speech input context identifies the framework in which to interpret the received speech input stream. The speech input context associates the speech input stream to a specific device function of the vehicle such as navigation or personal calling.

The received speech input is processed based on the determined speech input context (block **230**). The device function of the vehicle is enabled responsive to the processed speech input stream (block **240**). The vehicle device in control of the enabled device function of the vehicle is directed based on the processed speech input stream (block **250**). An example of a vehicle device is the navigation system of the vehicle and the corresponding device function of the vehicle is navigation. The method ends (block **295**).

FIG.3 is a flow diagram detailing the step of determining the speech input context at block **220** of **FIG.2**. The step of determining the speech input context at **300** begins (block **305**) with monitoring the speech input stream at a context recognizer (block **310**). The context recognizer comprises a context verbiage. The speech input stream is compared to the context verbiage (block **320**). An example of verbiage contained in the context recognizer is the word "street" preceded by a text string. This verbiage is use to identify an address as a component of the speech input stream.

In one embodiment, a speech input stream comprised of numerical utterances followed by non-numerical utterances is associated with a navigation destination address context. In another embodiment, a speech input stream comprised of numerical utterances is associated with a directory assistance context.

Each device function of the vehicle is assigned a domain specific actuator. The domain specific actuator contains a set of rules and structures that determine how to format the speech input stream for the corresponding vehicle device that controls the particular device function of the vehicle. One of a plurality of domain specific actuators is selected based on the comparison of the speech input stream to the context verbiage (block **330**) and the step ends (block **395**).

In one example of the system and method for enabling a device function of a vehicle, a subscriber contacts directory assistance to obtain a phone number for a business. The directory assistance operator speaks the phone number for the business. The spoken phone number is the speech input stream in this example. The context recognizer identifies the string of numbers as a phone number by matching the received phone number to context verbiage corresponding to a phone number string. The context recognizer having determined that a phone number is being received selects a domain specific actuator for personal calling. The speech input stream is then formatted so that

the phone number is available for use by the subscriber's in-vehicle phone or personal phonebook. The phone number is written to the activation cache and the personal calling device function is thereby enabled with the phone number data.

In another example, following on the previous example, the subscriber's personal calling is directed to request what action the subscriber would like to take regarding the received phone number. The personal calling device sends the subscriber a prompt asking the subscriber if they wish to dial or to store the phone number.

FIG. 4 is a flow diagram detailing the step of processing the received speech input stream at block **230** of **FIG. 2**. The step of processing the received speech input stream at **400** begins (block **405**) by accessing a set of rules and structures for formatting the speech input stream according the determined speech input context (block **410**). The set of rules and structures are contained in the domain specific actuator. The received speech input stream is formatted based on the set of rules and structures (block **420**). For example, if the speech input stream includes a phone number, the speech input stream is formatted so that the phone number and other relevant data, such as the entity associated with the phone number, is available to and in the proper format for personal calling. The step ends (block **495**).

FIG. 5 is a flow diagram detailing the step enabling the device function of the vehicle at block **240** of **FIG. 2**. The step of enabling the device function of the vehicle at **500** begins (block **505**) with writing the processed speech input stream in an activation cache (block **510**). The activation cache is a memory location where a vehicle device can access the processed speech input stream. The vehicle device corresponding to the enabled device function of the vehicle is activated (block **520**). The processed speech input stream from the activation cache is supplied to the vehicle device (block **530**) and the step ends (block **595**). In the example where the device function of the vehicle is personal calling the

vehicle device corresponding to personal calling is the in-vehicle phone. A phone number processed from the speech input stream and written to the activation cache would be supplied to the in-vehicle phone for dialing or storing.

While embodiments of the invention disclosed herein are presently considered to be preferred, various changes and modifications can be made without departing from the spirit and scope of the invention. The scope of the invention is indicated in the appended claims, and all changes that come within the meaning and range of equivalents are intended to be embraced therein.